


2013 SEAUPG Annual Meeting

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Multiple Stress Creep Recovery (MSCR) Overview

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Our Visit This Morning

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- What is MSCR test?
- What is the SEAUPG MSCR Task Force?
- What is the latest with the SEAUPG MSCR Task Force?
 - “MSCR Information” webpage
 - State Surveys
 - Consensus on a key issues
 - Some states moving forward with MSCR
- What is happening nationally?

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What is MSCR?

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- MSCR (*pronounced massacre*)
- The MSCR test is a new test for measuring high temperature properties of an asphalt binder.
- The MSCR test procedure (AASHTO TP 70) is performed using a Dynamic Shear Rheometer (DSR) to capture the non-recoverable creep compliance (J_{nr}) and percentage of recovery (MSCR Recovery) at different stress levels.

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What is MSCR?

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- Can replace the existing high temp. test for short term aged binder in M 320 ($G^*/\sin\delta$)
- J_{nr} can better relate predicted laboratory high temperature properties of polymer-modified binders to actual rutting performance of in-service pavements
- MSCR Recovery is faster/easier than Elastic Recovery and better characterizes the elastic behavior of modified binders

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What is MSCR?

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- It is the Asphalt Institute's opinion that MSCR represents a technical advancement over the current PG specification
- AI recommends that agencies move toward implementing MSCR
- It is recommended that this implementation be accomplished regionally or through the User Producer Groups

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What is the SEAUPG MSCR TF?

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- MSCR Task Force formed at 2010 SEAUPG Annual meeting
- First WebEx meeting on Jan 19 2011
- October 10 2013 was our 18th WebEx meeting
- We have come a long way since then!
 - With our understanding and experience with MSCR testing and specifications
 - With availability of reference materials, ILS studies, research and guidance documents
 - AI's "MSCR Information" webpage

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What is MSCR Task Force?

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- Purpose?
 - To move evaluation of MSCR test and specification forward
 - To provide guidance, information and resources for SEAUPG states
 - To identify and address any barriers to implementation
 - To conduct MSCR ILS and any other needed research
 - To consider possible implementation of MSCR in the future

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What is MSCR Task Force?

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- MSCR Task Force members
 - 14 State DOTs
 - 3 Binder Suppliers
 - 3 DSR Equipment Suppliers
 - 2 Commercial Labs (including NCAT)
 - Asphalt Institute

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"MSCR Information" Webpage

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Serving the needs of liquid asphalt manufacturers and suppliers worldwide since 1919.

HOME ABOUT AI STORE STATE SPEC DATABASES

MSCR Information

Home - Publications - MSCR Information

Free Webinar:

- [Understanding the MSCR Test and its Use in the PG Asphalt Binder Specification](#)

Guidance Documents

- [AI's Guidance Document on MSCR Implementation](#) (PDF 418 kb)
- [AI's Guidance Document on using MSCR with AASHTO M320](#) (PDF 344 kb)
- [FHWA Tech Brief on the MSCR Procedure](#) (PDF 771 kb)
- [SEAUPG - Use of MSCR to Replace PG Plus Tests](#) (PDF 41 kb)
- [SEAUPG - Guidance for Evaluation of MSCR Recovery to Replace PG Plus Tests](#) (PDF 83 kb)

Research Papers

- [NEAUPG MSCR ILS Final Report with Appendix](#) (PDF 1.1 mb)
- [SEAUPG MSCR ILS Final Report with Appendix](#) (PDF 476 kb)

Presentations

- [Why We Need MSCR](#) (PDF 1.89 mb)

2013 State Surveys Results and Discussion

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2013 Surveys of SEAUPG States

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- **April 2013** – Prepared by LADOT and conducted through AASHTO (SE)
 - Adoption of MP 19 for PG 76-22?
- **September 2013** – Conducted by AI
 - Regional adoption of MSCR Recovery on January 1 2014?
- **October 2013** – Conducted by AI
 - Consensus on test temperature and target date (non-binding) for regional adoption of MR of January 1 2015

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Conclusions From Survey

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- Based on surveys, we learned a lot about where each of the states are with studying and plans to implement MSCR
- There was no consensus on full regional implementation of MP 19 (J_{nr} and MSCR Recovery) now
 - Although there are a number of individual states that said they are ready to adopt MSCR in some manner fairly quickly

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Conclusions From Survey

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- A number of SEAUPG states are moving forward with full or partial MSCR implementation in 2014 (FL, LA, OK, etc)
- There is consensus on a couple of key issues:
 - test temperatures (either 64 or 67° C)
 - target date (non-binding) for MSCR Recovery (Jan 1 2015)

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What's Next for SEAUPG MSCR?

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- 2014 will be an interesting year with states including MSCR into their specs. and doing a lot of comparison binder testing
- WebEx meetings will continue indefinitely to learn from each other's experiences to address critical issues
- We will report back again at 2014 SEAUPG!

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National MSCR Activities

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- Binder Expert Task Group (ETG) working on improvements to test (TP 70) and specification (MP 19) and making recs. to AASHTO SOM
 - Draft Standard Practice for MSCR Recovery
- 2013 SOM meeting (TS 2b)
 - Requested guidance on selection of "environmental" temperature
 - Ballot various revisions suggested by ETG
 - Ballot moving TP 70 and MP 19 to full standards
- NEAUPG regional implementation 1/1/14
- Other AUPG also discussing MSCR

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QUESTIONS?

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April 2013 Survey

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April 2013 Survey - AASHTO

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- Purpose of Survey
 - Determine where states are with various issues related to implementation of MP 19:
 - Are states interested in adoption of MP 19 for PG 76-22 modified binders?
 - If so, questions about which RTFO binder temps. and stiffness?
 - If so, questions about which original binder temps?
 - If so, elimination of any PG Plus specifications?
 - If so, any other modified binders to be included?

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April 2013 Survey - AASHTO

- Summary of Survey Results
 - Some states were ready to implement MP 19
 - Other states were either not ready or unsure
 - The survey generated excellent discussion:
 - Test temperature(s)
 - QC testing on original (un-aged) binder
 - Concerns with changes in binders with MP 19
 - Possible elimination of current PG Plus tests (ER, phase angle) if MSCR Recovery is adopted

September 2013 Survey

September 2013 Survey - AI

- Purpose of Survey
 - Since there is not a consensus for regional adoption of MP 19:
 - Determine is there is a consensus by SEAUPG states to adopt MSCR Recovery as the regional PG Plus test on January 1, 2014
 - AI thinks that adoption of MSCR Recovery would be a good first step toward full MSCR implementation in the future
 - Adoption of MSCR Recovery will help to eliminate current PG Plus tests (ER)

Current PG Plus Tests in SEAUPG

- 12 of 14 SEAUPG states have a PG Plus test
- 9 states use Elastic Recovery
- 3 states use Phase Angle
- 2 states do not have a PG Plus test
 - MS has a polymer type and % requirement

Elastic Recovery Test Procedures

	State	Spec.	Binder Aging	Mold Sides	Test Temp.	Elong.	Wait Time	Exceptions
1	Alabama	AASHTO T 301	RTFO	Parallel	10° C	20 cm	5 minutes	The molds shall be in accordance with the requirements given in ASTM D 6084 with dimensions noted in this method.
2	Arkansas	AASHTO T 301	Original	Parallel	25° C	20 cm	5 minutes	
3	Kentucky	AASHTO T 301	RTFO	V Shape	25° C	10 cm	5 minutes	
4	Louisiana	AASHTO T 301	RTFO	Parallel	25° C	10 cm	5 minutes	
5	Oklahoma	ASTM D 6084 Method A	RTFO	Parallel	25° C	10 cm	Immediate	
6	Tennessee	AASHTO T 301	Original	Parallel	25° C	20 cm	5 minutes	
7	Texas	ASTM D 6084 Method A	Original	Parallel	10° C	10 cm	Immediate	
	Virginia	ASTM D 6084 Method A	RTFO	Parallel	25° C	10 cm	Immediate	
	West Virginia	AASHTO T 301	RTFO	Parallel	25° C	20 cm	5 minutes	

September 2013 Survey - AI

- Question 1:** Is your state in favor of adoption of MSCR % Recovery now or in the near future to replace existing PG Plus tests?
- Question 2:** Implementation Date of 1/1/14?
- Question 3:** If your state adopts MSCR % Recovery, would you eliminate current PG Plus tests?
- All 14 state DOTs responded to the survey!

September 2013 Survey

- There is not consensus to adopt MSCR Recovery regionally on January 1 2014
- Although a number of states are considering implementing MR now or in the near future
- Takeaways:
 - Need consensus among SEAUPG states on “environmental” test temperature
 - Need more time to do comparison testing to determine impact of changing from phase angle / ER to MSCR Recovery on binder properties
 - Need to set a target date (non-binding) for regional implementation of MSCR Recovery

October 2013 Survey

October 2013 Survey - A1

- During October 10th MSCR Task Force WebEx meeting:
 - From the September survey, there was not a consensus to adopt MSCR Recovery as the regional PG Plus test on 1/1/14
 - It was important to reach consensus on two items
 - Target date (non-binding) for regional MSCR Recovery implementation
 - MSCR test temperatures for SEAUPG states

Question #1

- Does your state agree with making the MSCR Recovery test temperature for SEAUPG states either 64° C or 67° C, depending on which of these standard unmodified binder grade is used in that state?
- 13 states responding
 - Yes – 13
 - No - 0

Question #2

- Does your state agree with establishing January 1, 2015 as the non-binding target date for SEAUPG states to adopt MSCR Recovery as the standard test for evaluating elastic behavior of a binder?
- 13 states responding
 - Yes – 12
 - No - 1

October Survey Summary

- The survey results will be discussed during the next MSCR Task Force WebEx meeting
 - It appears that we have reached general consensus in favor of both test temperature and target date for MSCR Recovery of 1/1/15
 - Many states will be doing comparison testing of MSCR Recovery and current PG Plus tests prior to 1/1/15

Goals of MSCR Task Force

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- Short Term
 - Conduct frequent WebEx meetings
 - Learn more about MSCR test and spec.
 - States start testing current binders
 - Identify barriers to implementation
 - Perform ILS
- Long Term
 - Regional adoption of MSCR Recovery
 - Regional adoption of full MSCR



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NEAUPG Adopts MP 19

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- At a recent WebEx meeting, NEAUPG states decided unanimously to:
 - Adopt MP-19 as a region effective on all contracts starting on January 1 2014
 - Modified binders only: H,V and E grades
 - Use current standard base grades of 58° and 64° C, however another WebEx is scheduled to discuss test temperatures (LTPPBind 3.1)
 - MSCR % Recovery as PG Plus test – criteria is above J_{nr} / MSCR Rec. curve in TP 70



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SEAUPG MSCR TF Activities

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- Five WebEx meetings
- Three Surveys of 14 SEAUPG state DOTs
 - LA through AASHTO – Full Implementation
 - AI – Regional Implementation of MSCR Rec%
 - AI – Regional test temperatures and target regional MSCR Recovery implementation date



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First Survey: SE AASHTO

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- 14 of 14 States Responded
- Is your state ready to implement MP-19?
 - 7 yes
 - 3 no
 - 4 wait and see
- Conclusion:
 - No consensus for MSCR regional implementation now
 - A number of states are considering either full or “partial” implementation on a state-by-state basis



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What Does Implementation Mean?

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- “Full” implementation means adoption of MP 19:
 - Jnr to replace $G^*/\sin\delta$ for high temperature characterization
- “Partial” implementation means adoption of MSCR Recovery only
 - Current PG Plus tests may or may not be eliminated



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What is MSCR Task Force?

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- SEAUPG 2010 Annual Meeting in OK City Binder Task Group – proposed forming a MSCR Task Force to start looking at MSCR test/specification from a regional standpoint
 - Asphalt Institute volunteered to facilitate
 - Formed a diverse group of industry and agency
 - Meet using AI Webex multiple times per year
 - **Move evaluation of MSCR along more rapidly**
 - Provide regular updates at SEAUPG annual meetings


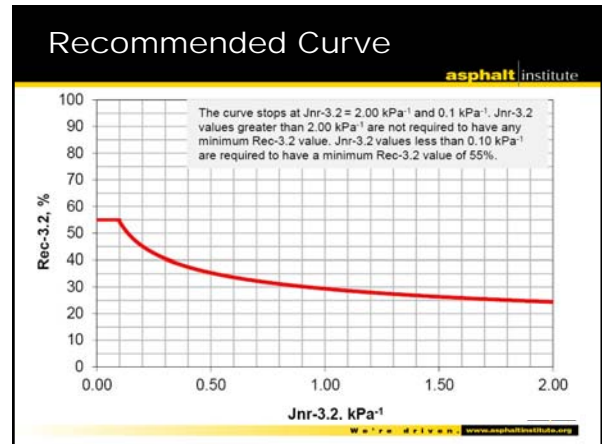


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September 2013 Survey - AI

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- Survey was accompanied by draft AASHTO “Standard Practice for Evaluating the Elastic Behavior of Asphalt Binders Using the Multiple Stress Creep Recovery (MSCR) Test”
- AASHTO document included the “new” Jnr-3.2 versus Rec-3.2 curve developed by the Binder ETG.
- This document was provided as the recommended practice to be used by SEAUPG states.

Survey – MSCR Recovery

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- Survey Summary
 - All 14 states responded
 - **Question 1:** Is your state in favor of adoption of MSCR % Recovery now or in the near future to replace existing PG Plus tests?
 - Yes - 10 states
 - No - 4 states
 - NC and MS do not use PG Plus tests
 - WV does not have upgraded DSR
 - TN maybe in the future



Survey – MSCR Recovery

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- Survey Summary
 - **Question 2:** Implementation Date of 1/1/14?
 - Yes - 1 state (FL already implemented)
 - Yes, plan to implement soon – 4 states
 - But can't do it by that date
 - No or no response – 9 states
 - Performing comparison of MSCR Recovery and current PG Plus lab testing
 - Need to reach consensus on test temperature first



Survey – MSCR Recovery

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- Survey Summary
 - **Question 3:** If your state adopts MSCR % Recovery, would you eliminate current PG Plus tests?
 - Yes - 7 states
 - OK would eliminate ER but maybe not other PG+ specs.
 - No - 3 states
 - Florida adopted the %Recovery test, but has not eliminated the phase angle test due to the need of a QC test for the binder suppliers on original binder.
 - No comment – 4 states
 - NC and MS – no current PG Plus tests to eliminate



Discussion of Survey Results

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- Some states are ready to move forward with adoption of MR
 - We will likely see a number of states doing this individually in 2014 (LA, OK, SC, TX)
- All states are not ready to implement MR
 - Should we try to agree on a non-binding date for goal of regional implementation?
 - All states adopt MSCR Recovery as PG Plus test
 - Jan 1, 2015?

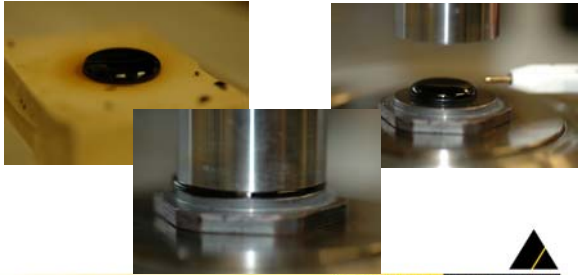


Conclusions and Takeaways

- There is not unanimous consensus to adopt MSCR Recovery regionally at this time
- A number of states would consider implementing now or in the near future
- Concerns with states are:
 - Need consensus among SEAUPG states on “environmental” test temperature
 - Need more comparison testing to determine impact of changing from phase angle or ER to MSCR Recovery on binder properties

What is MSCR?

- Sample prep is exactly the same as the existing RTFOT Dynamic Shear Rheometer



Why Do We Need MSCR?

- May eliminate the need for current “PG Plus” tests for modified binders
 - Elastic Recovery, Phase Angle, etc.
 - Use MSCR Recovery to measure the elastic response of the binder

What is MSCR?

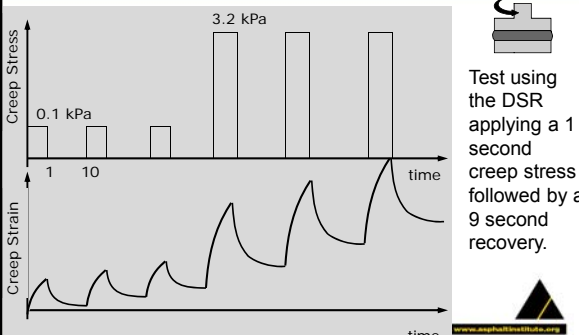
Definitions:

Creep and recovery – a standard test protocol whereby a specimen is subjected to a constant load for a fixed time period and then allowed to relax (recover) at a zero load for a fixed time period

Percent Recovery – A measure of how much the sample returns to its previous shape after being repeatedly stretched and then relaxed

Non-Recoverable Creep Compliance (J_{nr}) – a measure of the amount of residual strain left in the specimen after repeated creep and recovery, relative to the amount of stress applied

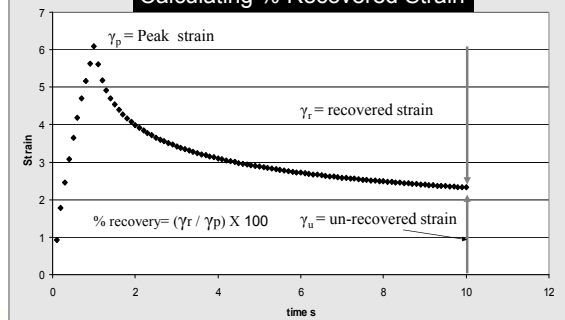
What is MSCR?



Test using the DSR applying a 1 second creep stress followed by a 9 second recovery.

What is MSCR?

Calculating % Recovered Strain

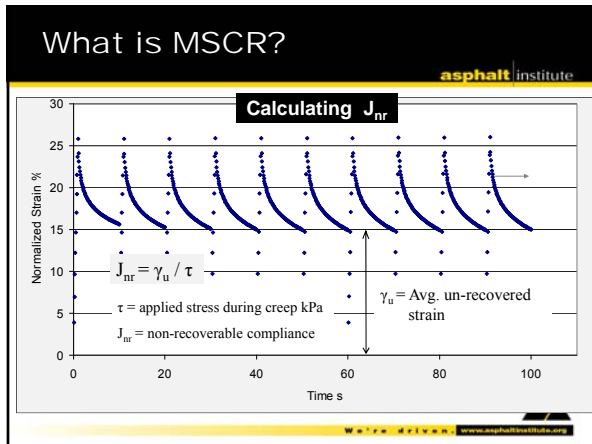


γ_p = Peak strain

γ_r = recovered strain

γ_{nr} = un-recovered strain

$\% \text{ recovery} = (\gamma_r / \gamma_p) \times 100$



- ### Survey – MSCR Recovery
- Survey of SEAUPG States – Regional Adoption of MSCR Recovery
 - Background – MSCR Task Force
 - Why did AI suggest adoption of MSCR Recovery test?
 - What was the purpose for the survey?
 - Summary of survey responses
 - Discussion of selected states responses
 - Conclusions and takeaways from survey

- ### Survey – MSCR Recovery
- Background
 - MSCR Task Force formed at 2010 SEAUPG Annual meeting
 - First WebEx meeting on Jan 19 2011
 - This is the 18th WebEx meeting
 - We have come a long way since then!
 - With our understanding and experience with MSCR testing and specifications
 - With availability of reference materials, ILS studies, research and guidance documents
 - AI's "MSCR Information" webpage

- ### MSCR Task Force
- Purpose?
 - To move evaluation of MSCR test and specification forward
 - To provide a resource and information for all SEAUPG states
 - To identify and address any barriers to implementation
 - To conduct MSCR ILS
 - To consider possible implementation of MSCR in the future

- ### Survey – MSCR Recovery
- Rationale for AI to suggest adoption of MSCR Recovery test?
 - Recent survey by LA DOT showed there was not a consensus to full adoption of MP 19 at this time
 - However, AI perception is that all states were interested in continuing to move forward
 - AI felt that adoption of MSCR Recovery would be a significant first step toward possible full implementation of MP 19 in the future
 - Regional adoption of MSCR Recovery as the standard PG Plus test would help eliminate current PG Plus tests